

PATENT SPECIFICATION

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- (21) Application No. 48301/73 (22) Filed 17 Oct. 1973
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 (44) Complete Specification published 1 Feb. 1978
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 H4J 24B1A 24C1 24E 24F



(54) HEARING AIDS

(71) I, JAMES ROBERT JOSEPH RUTHERFORD of 5 Warren Mead, Banstead, Surrey. British do power source and either for the sound output from the receiver

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SPECIFICATION No. 1,499,976

Page 1, line 16, for present read preset
 Page 1, line 76, for badpass read bandpass
 THE PATENT OFFICE
 1st May, 1978

the resultant signals being applied to the input of an amplifier. The output signal of the amplifier is controlled by means of an amplifier volume control before being applied to the receiver. In order to contain the system physically, microcircuitry is used where practical.

In a preferred embodiment the bandpass filters together with their respective variable attenuators, and the amplifiers are of module form for ease of servicing or replacement. The variable attenuators are lockable and can be preset. A common housing may be provided for the microphone, the bandpass filters together with, variable attenuators and the amplifier and access space for the battery/power source. The receiver may be within the housing, or outside, but in either case it is connected to the amplifier by electrical leads. Openings may be provided in the housing for the sound input to the microphone, for the amplifier volume control, for insertion and removal of the

and then respective variable attenuators 3 are applied to an amplifier 2 having a user operated volume control. The output from the amplifier 2 is applied to the receiver 1.

The badpass filters 4 are preset by means of their attenuators 3 to compensate for the hearing loss of the user as far as possible and then locked. The user may subsequently adjust the volume control of the output amplifier 2 in accordance with his needs so that the volume of sound from his receiver 1 does not reach the level at which he feels discomfort.

As shown in Figure 2 an audio frequency band of width a—g is divided into six adjacent bands, a—b, b—c, c—d, d—e, e—f, f—g, corresponding to the six pass bands of the filters 4 (Figure 1) of the hearing aid. An audiogram of a person with normal hearing is represented by graph 1 in Figure 2. An audiogram of a person with a hearing loss is represented by graph 2 in Figure 2. Reference 3 of Figure 2 represents the minimum hearing loss level. The hearing loss is determined in each of

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(54) HEARING AIDS

(71) I, JAMES ROBERT JOSEPH RUTHERFORD of 5 Warren Mead, Banstead, Surrey, British, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention related to hearing aids. The object of the invention is to provide hearing aids which compensate for a hearing loss for an aurally handicapped person over a wide range of frequencies by means of a plurality of parallel connected bandpass filters and their respective variable attenuators which can be present and locked, so that in use the resultant signal response is adjusted to the needs of the user before final amplification. According to the invention there is provided a hearing aid comprising a microphone connected to a plurality of parallel connected bandpass filters having respective variable attenuators which can be preset, the resultant signals being applied to the input of an amplifier. The output signal of the amplifier is controlled by means of an amplifier volume control before being applied to the receiver. In order to contain the system physically, microcircuitry is used where practical.

In a preferred embodiment the bandpass filters together with their respective variable attenuators, and the amplifiers are of module form for ease of servicing or replacement. The variable attenuators are lockable and can be preset. A common housing may be provided for the microphone, the bandpass filters together with, variable attenuators and the amplifier and access space for the battery/power source. The receiver may be within the housing, or outside, but in either case it is connected to the amplifier by electrical leads. Openings may be provided in the housing for the sound input to the microphone, for the amplifier volume control, for insertion and removal of the

power source and either for the sound output from the receiver or for electrical leads to a receiver mounted in a separate earpiece.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 shows an embodiment of a hearing aid in accordance with the invention, and

Figure 2 shows an audiogram of a person with normal hearing and an audiogram of a person with a determined hearing loss.

Referring to Figure 1, there is shown a hearing aid comprising a microphone 5, the output signal of which is applied to six parallel connected bandpass filters 4, each including a variable attenuator 3. Each bandpass filter 4, together with its variable attenuator 3, is in the form of a module which is readily removable for servicing or replacement, as is amplifier 2.

The outputs from the bandpass filters 4 and their respective variable attenuators 3 are applied to an amplifier 2 having a user operated volume control. The output from the amplifier 2 is applied to the receiver 1.

The bandpass filters 4 are preset by means of their attenuators 3 to compensate for the hearing loss of the user as far as possible and then locked. The user may subsequently adjust the volume control of the output amplifier 2 in accordance with his needs so that the volume of sound from his receiver 1 does not reach the level at which he feels discomfort.

As shown in Figure 2 an audio frequency band of width a—g is divided into six adjacent bands, a—b, b—c, c—d, d—e, e—f, f—g, corresponding to the six pass bands of the filters 4 (Figure 1) of the hearing aid. An audiogram of a person with normal hearing is represented by graph 1 in Figure 2. An audiogram of a person with a hearing loss is represented by graph 2 in Figure 2. Reference 3 of Figure 2 represents the minimum hearing loss level. The hearing loss is determined in each of

the bands a—b, b—c, c—d, d—e, e—f, f—g, and six bandpass filters in the hearing aid are adjusted by adjustment of their attenuators 3 (Figure 1) to compensate for the hearing loss as far as possible. Graph 5 (Figure 2) represents the maximum hearing loss level.

In a practical construction the microphone 5 (Figure 1), bandpass filters 4 (Figure 1) and their variable attenuators 3 (Figure 1), and amplifier 2 (Figure 1) are in a common housing (not shown). The receiver 1 (Figure 1) may be in this common housing or may be in a separate earpiece. It is electrically connected to the output of the amplifier 2 (Figure 1) by leads. The housing has a shielded opening for the input of sound to the microphone an opening for the user operated amplifier volume control and an opening for the insertion and removal of a battery. Another opening is for the receiver or for leads to the ear. If the housing is to be ear mounted, its dimensions are approximately 10 mm×10 mm×30 mm, but this is not a limiting factor. It is preferably moulded to the shape of the supporting surface of the ear.

It is to be understood that as many as six bandpass filters and their respective attenuators need not be used, and that the minimum necessary is preferably used.

WHAT I CLAIM IS:—

1. A hearing aid comprising a microphone connected to a plurality of parallel connected bandpass filters having

respective variable attenuators which can be preset, the resultant signals being applied to the input of an amplifier where the output signal is volume controlled by the user by means of an amplifier volume control before being applied to a receiver.

2. A hearing aid as claimed in claim 1 in which microcircuitry is used.

3. A hearing aid as claimed in claim 1 or 2, wherein the bandpass filters together with their respective variable attenuators, and the amplifier are of module form for ease of servicing or replacement.

4. A hearing aid as claimed in claims 1 to 3 in which the attenuator controls are lockable.

5. A hearing aid as claimed in claims 1 to 4 in which the microphone, the bandpass filters together with their variable attenuators and the amplifier are in a common housing.

6. A hearing aid as claimed in any one of the previous claims in which the microphone, the bandpass filters together with their variable attenuators, and the amplifier are in a common housing which also contains a battery space and openings are provided in the housing for sound input to the microphone, for the amplifier volume control, for insertion and removal of the power source, and for leads to a receiver mounted in an earpiece.

7. A hearing aid substantially as hereinbefore described with reference to the accompanying drawing.

JAMES R. J. RUTHERFORD.

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COMPLETE SPECIFICATION

2 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale*

Sheet 1

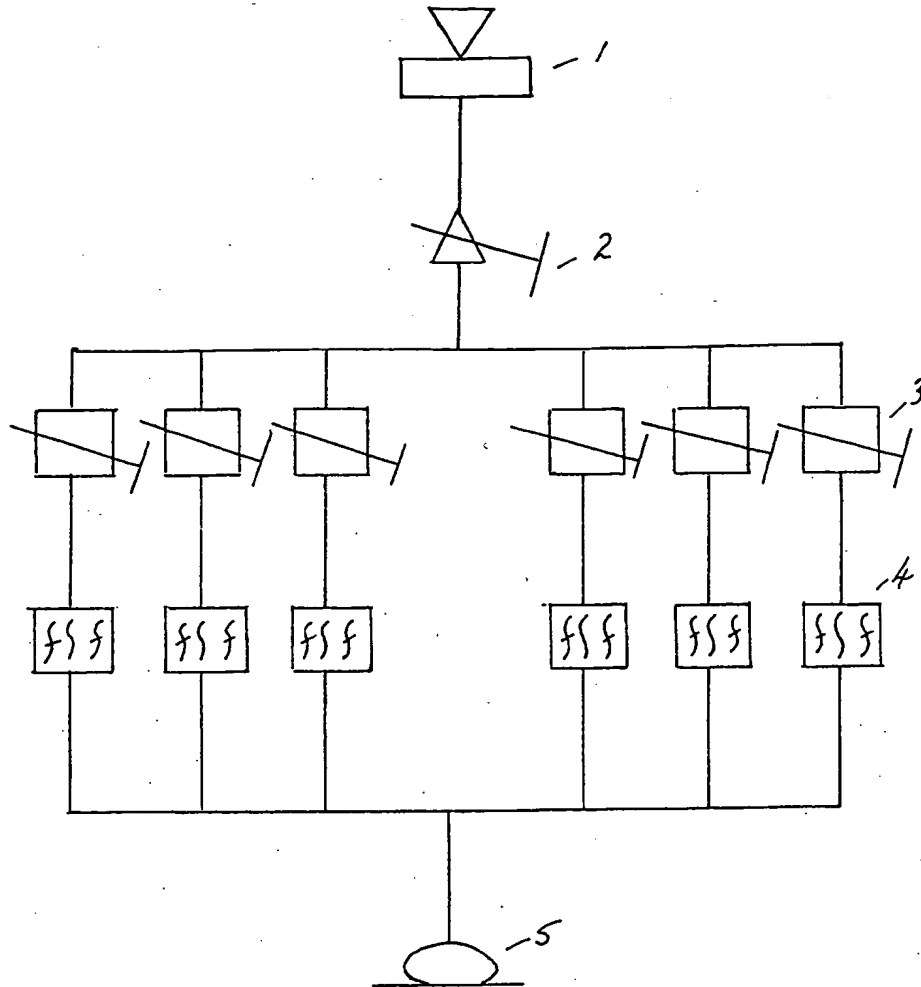


FIG 1.

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Sheet 2

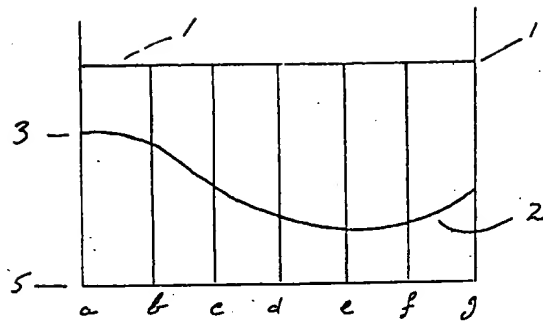


Fig 2

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